CHAPTER 1

INTRODUCTION

1.1 Background

Concrete has been used in construction for more than a century now and a number of existing structures exhibit distresses and/or lack of load-carrying capacity. Repair and strengthening of existing structures are in fact among the biggest challenges civil engineers will have to face in the years to come. Among different approaches that can be considered for concrete rehabilitation, bonded overlays are often the most economical alternative. Overlays are particularly suitable in the case of structures with large surface areas, where it can be either poured or sprayed. The following types of applications are of special concern slabs on grade for example, industrial floors, pavements, bridge decks, walls and tunnels. Toppings and linings are also relevant to the same type of problem.

The primary purpose of overlays is to extend the life of the candidate concrete structures, either by restoring a smooth sound surface and/or the original load-carrying capacity, or by improving the load-carrying capacity by a thickness increase. For a slab or pavement in good condition, a 25 % increase in thickness can nearly double its stiffness in some cases, resulting in nearly a 50 % reduction in flexural stress and a significant increase of its service life (Star & Committee, 2011).

One of the biggest problems impacting the long-term performance of concrete repairs and bonded overlays is cracking of the repair material and repair material debonding from the concrete substrate. There are many purposes for concrete repair, including prolonging the useful service life of a deteriorated or distressed structure or element, restoring the load carrying capacity and the stiffness, and strengthening the structure. In most cases, for the repair to be successful, monolithic action (acting as one unit) between the repair material and the substrate concrete (the composite repair system) is needed. A prerequisite for monolithic action is long lasting bond between the existing concrete substrate and the repair material (Bissonnette et al, 2012).

The primary purpose of overlays is to extend the life of a concrete slab or pavement, bridge deck or other structural slab. It has been shown that as the remaining life of a pavement decreases due to distress, e.g. cracking, spalling or punch outs, the life can be extended significantly by the use of a bonded concrete overlay (Star & Committee, 2011).

1.2 Problem Statement

Concrete constructions require proper care in the form of regular maintenance. Buildings remain for several years without getting due attention. Water stagnation, paint peeling, plaster break- off, fungus growth, cracking of external rendering and cover concrete are common and widespread. Penetration of moisture into reinforced concrete components promotes corrosion process and further damages the concrete cover (CPWD, 2002).

Among other effects, moisture levels determine the risk of corrosion attack occurring on steel reinforcement and the rate of deleterious mechanisms such as alkali-aggregate reaction (AAR). At the same time a long-term ageing effect caused by drying-out of the cement matrix in concrete will be evident and the result will be reduced strength. A combination of dry and wet concrete may cause differential shrinkage which in turn may well lead to cracking. A balanced and stable moisture level would seem to be desirable, but cannot be achieved since the structural members are subject to different environments (Soudki, 2001).

For maintaining buildings often begin repair activity without adequate understanding of the factors responsible for the defects. The repairs strategy adopted is replacement of damaged materials without dealing with the real problems. Many engineers unintentionally attempt treating the symptoms, instead of dealing with the cause and effect phenomenon. Such an approach may offer a quick action with minimum inconvenience to the occupants (CPWD, 2002).